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Attorneys for Defendants

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
OAKLAND DIVISION

REARDEN LLC et al.,
Plaintiffs,
vs.
THE WALT DISNEY COMPANY et al.,
Defendants

REARDEN LLC et al.,
Plaintiffs,
vs.
TWENTIETH CENTURY FOX FILM
CORPORATION et al.,
Defendants.

Case Nos. 4:17-cv-04006-JST
4:17-cv-04191-JST

**DECLARATION OF DARREN
HENDLER IN SUPPORT OF
DEFENDANTS' MOTION FOR
SUMMARY JUDGMENT ON CAUSAL
NEXUS**

Judge: Hon. Jon S. Tigar
Date: To be set
Time: To be set

Ctrm.: 6 (2nd Floor)

1 I, Darren Hendlar, declare:

2 1. I am Vice President and Creative Director at Digital Domain 3.0, Inc. (“DD3”). I
3 have been employed by DD3 or one its predecessors or affiliates since October 1999. I am
4 submitting this declaration in support of Defendants’ Motion for Summary Judgment on Causal
5 Nexus Issue. The plaintiffs in this case deposed me on June 12, 2020. The contents of this
6 declaration are based on matters within my personal knowledge or (where indicated) matters as to
7 which I am reliably informed and believe to be true. If called as a witness in this action, I could
8 and would competently testify to the matters set forth herein.

9 2. I was the Digital Effect Supervisor responsible for DD3’s work on the live-action
10 film *Beauty and the Beast*, which was released to United States theaters in or around March of
11 2017 (“BATB”). My responsibilities on BATB included supervising the process by which the
12 character of the Beast was developed and animated, and supervising the look of the Beast.

13 3. I have reviewed the declaration that Greg LaSalle, a former DD3 employee,
14 submitted in this litigation. In his declaration, Mr. LaSalle stated that more than a hundred DD3
15 artists, animators, and supervisors were involved in creating shots in which the Beast appeared in
16 BATB, and that those individuals logged more than 170,000 hours working on the Beast and
17 compositing the shots in which the Beast appeared. I am informed and believe that at his
18 deposition, Mr. LaSalle testified (a) that he could not recall if the 170,000 hours referenced in his
19 declaration included hours that DD3 personnel spent on the Mova facial performance capture of
20 Dan Stevens (the actor who played the Beast) and the processing of that data using the Mova
21 software; and (b) that DD3’s payroll department likely would be able to determine how many
22 hours were spent on such tasks based on codes that employees used to track their time.

23 4. Information provided to me by DD3’s Production Finance team shows that less
24 than 1% of the time DD3 personnel spent on BATB was related to capturing facial performances
25 using Mova or to processing the resulting output using Mova software.

26 5. This is consistent with my experience working on BATB, which I described at my
27 deposition. In that experience, the vast majority of hours spent by DD3 personnel on the Beast
28 character did not involve the use of Mova software.

1 6. Additionally, as I testified at my deposition, to the extent that Mova output was
2 used in the process of creating particular shots that included the Beast and that appeared in the
3 movie, the impact of that Mova output on the final appearance of the Beast in such shots was
4 negligible.

5 7. Below, I elaborate on and provide some examples to illustrate my deposition
6 testimony.

7 **Steps Taken to Create the Beast**

8 8. DD3 animated the Beast character for use in multiple “shots” in BATB.

9 9. A shot is a continuous piece of action between two cuts in the motion picture as it
10 appears on screen. A new shot starts every time there is a cutaway between camera framings. A
11 scene may be composed of one or more shots. A frame is a single still image. There are
12 approximately 24 frames per second of footage in a motion picture like BATB.

13 10. DD3’s work on shots including the Beast involved the work of numerous teams
14 using many different types of software and processes. The Mova team, which was responsible for
15 operating the Mova rig and processing the output of the facial motion capture session, was just one
16 of many different teams involved in the process. Shots including the Beast typically involved the
17 work of over a dozen other teams, including shot model, facial shot model, texture, rig, layout,
18 integration, matte paint, animation technical director (“atd”), rotomotion, paint, compositing,
19 compositing final gauntlet, environment, environment light, CFX (which includes clothing
20 simulation and hair simulation), fx, light, and editorial. DD3 also used many different software
21 tools besides Mova in the process of developing shots including the Beast. Those tools included
22 Direct Drive (discussed further below); proprietary WPSD software to correct face shapes to better
23 match the Beast; proprietary Copy Cat software to align facial motion to the hand-generated Beast
24 face and to layer on secondary motion; Autodesk’s Maya software and custom DD3 face software
25 to animate the Beast face to add eyes, tongue and body motion, and to create a more nuanced
26 performance and add back missing motions; and Maya, Zbrush and Mudbox Sculpt for facial shot
27 modeling. Some other software tools that DD3 used in the process of developing shots that
28 included the Beast are Substance Painter, Foundry Nuke, SideFx Houdini, SideFx Mantra, Chaos

1 V-Ray, Z-Brush, Speed Tree, Adobe Photoshop, Bokeh (for Nuke), Ocula (for Nuke), Furnace
2 (for Nuke), Avid, Adobe Lightroom, 3D Equalizer, PhotoScan, Track, SoupTools for Maya,
3 Cyslice, RV, DMX, Packrat, and Smeat.

4 11. For each shot involving the Beast that DD3 worked on, DD3 created a virtual 3D
5 environment using computer graphics. The 3D environment on the computer screen had to
6 include numerous elements that would exist if a shot were being filmed in the physical world. The
7 environment had to include the background, the effects, and the characters such as the Beast. The
8 3D environment on the computer screen had to be virtually lit, just as lighting would be required
9 for filming a scene on a physical set. And the shot had to be filmed. For these computer
10 generated shots we use “virtual cameras.” A virtual camera serves a similar purpose to a physical
11 camera: the virtual camera exists in the virtual environment and films the action as it is taking
12 place in that environment. The virtual cameras had to be placed in the virtual 3D environment.
13 And a virtual camera, like its physical world analogue, can be moved, panned, tilted, zoomed,
14 have its lens aperture changed, etc. Mova software was not used to create the 3D environment.

15 12. The process of developing the computer-generated character of the Beast for a shot
16 involved multiple steps, not only for the Beast but for the rest of the shot. With respect to the
17 Beast, these steps included developing a foundational design and animating the Beast character for
18 specific shots. Each of these steps involved extensive work, as was also required for the remaining
19 elements of each shot.

20 13. The foundational design of the Beast included creating a 3-dimensional model of
21 the Beast’s face and body representing the skin that lay under his fur. To make the Beast’s face
22 move, DD3 created a separate face-driver rig (facial rig). This facial rig consisted of hundreds of
23 custom expressions, e.g., smile, eye blink, brows raised. These and other custom expressions were
24 all modeled individually by the modeling team. DD3 also created a separate body-driver rig that
25 would move parts of the Beast’s body. The facial rig and the body rig could be used by the
26 animation department to create motion on the Beast’s face and body. Mova software was not used
27 to create these rigs.

28 14. After DD3 designed the foundation of the Beast, we animated it for particular

1 shots.

2 15. DD3 used Mova software for some but not all of those shots. For facial
3 performance capture sessions, which occurred separate from on-set filming, DD3's Mova team
4 operated the Mova rig. I understand from the Mova team that the Mova software was used to
5 control the cameras, lights, and recording when Mr. Stevens's facial motion performances were
6 captured while he was in the Mova rig. During these capture sessions, several of the cameras in
7 the Mova rig would capture video of Mr. Stevens's performance. In this declaration I refer to that
8 video as Mova reference footage. Mova reference footage was primarily used for quality control
9 purposes, as described below.

10 16. The Mova team also used Mova software in the course of processing output data
11 from the captured performance including, most notably, for the creation of a "tracked mesh." The
12 tracked mesh output data can be "rendered" on a computer monitor as a white mask, with empty
13 sockets where the eyes and mouth should be. Maya, from Autodesk, was used to create the mask
14 rendering of the tracked mesh output data. Figure 3, which appears in Paragraph 27 below,
15 contains an example of such a tracked mesh rendering. The tracked mesh output data does not
16 include any data points for hair, for much of the neck, or for any part of the actor's body below
17 that. Mova software was not used at any other point in the process of creating the Beast.

18 17. We used Mova tracked mesh output data in our process for creating some, but not
19 all, of the shots in which the Beast's face appears in BATB. Mova tracked mesh output data was
20 not used at all in the creation of almost half of the shots in which the Beast's face appears in the
21 finished BATB film. DD3 worked on 677 distinct shots for BATB, 411 of which involved the
22 Beast. Of the 411 shots involving the Beast's face, the animation team took delivery of Mova
23 tracked mesh output data for 227 shots. Some of the 227 did not actually use the Mova tracked
24 mesh output data.

25 18. For BATB, DD3's Mova team delivered tracked mesh output data to DD3's visual
26 effects team using the following process. First, the Mova team provided the BATB production
27 team (which we referred to as "editorial" and which was not a DD3 team) with reference footage
28 from the Mova capture sessions. The footage was provided to editorial in the widely used

1 QuickTime format, which was developed by Apple and is not proprietary to Mova. Editorial
2 would select the take of the facial performance that best reflected their intentions for the shot and
3 send DD3 QuickTime files with their selection.

4 19. Upon receipt of the reference footage, DD3's visual effects team would place a
5 copy of those files in the DMX system (discussed below) and the Mova team would begin the
6 process of generating the tracked mesh output data that corresponded to the take selected by
7 editorial. When that tracked mesh output data was ready, DD3's Mova team provided the data and
8 the mask-like rendering of it to DD3's visual effects team. As I said above, tracked mesh output
9 data was delivered to the visual effects team for 227 of the 411 shots that include the Beast's face.

10 20. That tracked mesh output data was not used on all shots for which it was delivered,
11 but when it was used in the process of developing a particular shot, DD3 used the following
12 process to animate the Beast.

13 21. First, DD3's animators took a model of the Beast with the face and body rigs and
14 animated that model, including the face. This part of the process did not involve use of the Mova
15 software or its output data and was instead modelled footage of Mr. Stevens's on-set performance
16 (i.e., with a set, with scene lighting, and with other actors involved in the scene). During his on-set
17 performance, Mr. Stevens would be wearing a bulky body suit, looking somewhat like the
18 Michelin Man on stilts. The footage of Mr. Stevens's on-set performance is referred to as "the
19 plate performance." This is distinct from Mr. Stevens's "facial performance" or "Mova plate
20 performance," which is what Mr. Stevens did while alone in the Mova rig.

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22. A frame of Dan Stevens's plate performance for a shot is shown below. Mova software was not used to capture footage or process data from the plate performance.

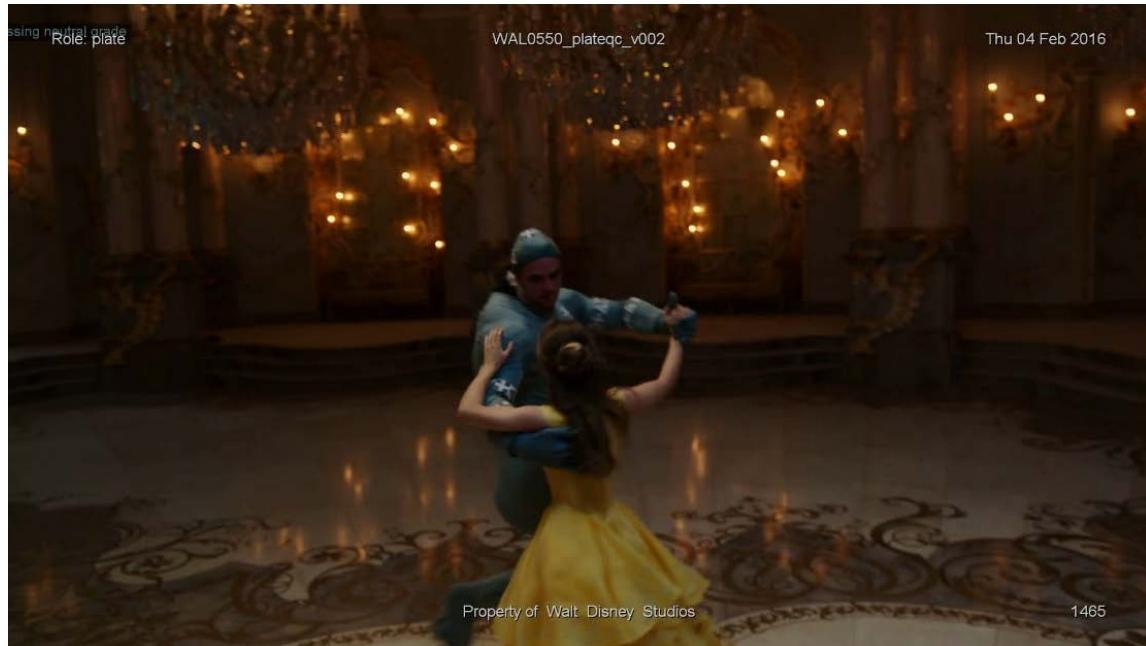


Figure 1

23. A frame showing the same shot with basic animation of the Beast (before Mova tracked mesh output data was applied to the shot and before much of the other work described in this declaration) is shown below.



Figure 2

24. True and correct copies of videos of the full shot from which the screenshots of

1 these frames (and other frames mentioned below) were taken are attached as exhibits, and
2 described more fully below.

3 25. Second, the animators used a DD3-proprietary process called Direct Drive to apply
4 the Mova tracked mesh output data to fine-tune the facial performance animation. DD3's
5 proprietary software retargeted the facial deformation of Mr. Stevens's face to the Beast's face.
6 Immediately after that process, the facial modeling team hand-sculpted corrections to many of the
7 poses. For example, retargeting the facial deformation of Mr. Stevens's smile did not result in
8 facial deformation of the Beast that looked the way we wanted it to look, so the facial modeling
9 team modified this facial pose by hand sculpting the shape we wanted the Beast to have when the
10 Beast smiled. The facial modelling team used DD3's proprietary WPSD tool for these hand-
11 modifications. Once the facial modelling team hand-modified a particular pose, WPSD was used
12 to automatically apply that modification to other instances of that pose. Thus, WPSD was
13 modifying the Beast's facial poses, after the retargeting of Mr. Stevens's facial deformations to the
14 Beast, each and every time Mova tracked mesh output data was used to partially animate the
15 Beast.

16 26. The Direct Drive process is not exclusively used with Mova tracked mesh output
17 data. Its core function is to transfer animation from one shape to another and it performs that
18 mapping function with various types of input, including data from a variety of other facial motion
19 capture performance systems. We refer to the mapping of tracked mesh output data by Direct
20 Drive as "ingestion."

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1 27. The figure below shows a frame that includes a rendering of the tracked mesh
2 output data for the shot referenced above, which looks like a white mask. That rendering is
3 depicted side-by-side with reference footage of Dan Stevens' facial motion performance in the
4 Mova rig.



Figure 3

15 28. The figure below shows a frame of the facial rig, which looks like a hairless clay
16 sculpture, after the tracked mesh output data is ingested into this shot by Direct Drive and applied
17 to the animation team's facial model of the Beast.



Figure 4

29. The Figure below shows a version of the shot incorporating the ingested data into
 30. the shot, before any additional hand animation is done. At this stage of development, the shot is
 31. far from a finished product.

**Figure 5**

30. Third, DD3 animators worked to manually adjust and correct the results of the
 31. ingestion process. For example, Mr. Stevens's facial movements, as represented in the tracked
 32. mesh output data, were often too subtle to show up clearly on the Beast's face. When this
 33. happened, the animation team would re-animate the movements of the facial rig by hand to
 34. exaggerate the performance. The animation team did not use Mova software to make those
 35. adjustments. This work was performed by artists using their artistic talent, skill, and judgment.

36. Fourth, DD3 animators hand-animated the performance of the Beast's eyes and
 37. made adjustments to the mouth for each shot. The animators did this without any mapping of
 38. tracked mesh output data because, as I noted above, the tracked mesh data did not include data for
 39. the eyes or much of the lips.

40. Fifth, after the face and body animations were approved, the moving 3D model of
 41. the Beast's face and body would go to the shot model team. In many cases, the final poses of the
 42. Beast's face or body out of animation would not be pleasing and/or would not appear realistic.

1 These issues were largely due to the differences between Mr. Stevens's face and the Beast's face.
2 In these cases, the shot model team would go frame by frame, adjusting and correcting the facial
3 expressions or body poses. The shot model team did not use Mova software in their process. The
4 shot modeling was performed by artists using their artistic talent, skill and judgment.

5 33. When refining the shot, animators would sometimes rely on reference material to
6 guide and inspire their work. Reference materials may be still or video images of Mr. Stevens's
7 recorded performances or of other individuals, animals, or objects. Most reference stills or videos
8 of Mr. Stevens's performance came from the plate performances. Reference footage of the Mova
9 performance was occasionally used by the animators, but its utility for making refinements to the
10 Beast's face was limited, and it was never used as a reference for the eyes, eye lines, or head
11 position. Again, this is because the actor was seated and alone in the Mova rig during the facial
12 motion capture sessions, thereby making his head pose and eye lines incorrect relative to the
13 primary plate performance. As a result, the plate performance generally depicted the goal of what
14 we were trying to achieve. The reference footage from the Mova facial performance sessions was
15 used for quality control (e.g., to compare the reference footage provided by the Mova team with
16 the reference composite video from editorial to help confirm that the Mova team had provided
17 data for the correct take, or to compare against the tracked mesh to confirm the tracked mesh data
18 was from the correct take or to check if it had internal data integrity flaws).

19 34. The result of the five steps described above was the completed model, or rig, of the
20 Beast for a particular shot. The shot would be provided to DD3's character effects team (CFX).
21 CFX was responsible for putting the hair/fur and clothing on the Beast. Once these items were
22 applied to a shot, the CFX team had to ensure the items moved correctly with respect to all the
23 Beast's movements (e.g., the Beast's dancing) and environmental effects, such as wind. During
24 the CFX process, the animation team frequently would have to revisit the facial animation
25 because, for example, the fur on the Beast's face resulted in facial expressions not reading clearly
26 enough. The CFX team did not use Mova software in this process. The CFX work was performed
27 by artists using their artistic talent, skill and judgment.

28 35. A complete shot also requires lighting. The lighting team simulated realistic

1 lighting on the Beast, including the Beast's fur and hair; rendered it; and checked that the lighting
 2 fit into the environment of the overall shot. The impact of lighting on the character affects how the
 3 Beast's performance looks on the screen. Therefore, after lighting effects were added, the
 4 animation team often again had to revise the Beast's performance, including its facial
 5 performance. The lighting and animation teams did not use Mova software in this process. The
 6 lighting work was performed by artists using their artistic talent, skill and judgment.

7 36. In addition, there were teams working on environments (e.g., the castle, set
 8 extensions, backgrounds) and effects (e.g. snow, Beast saliva, Beast spittle, dirt and twigs in the
 9 Beast's fur, etc.). The environment teams did not use Mova software in this process. The
 10 environment work was performed by artists using their artistic talent, skill and judgment.

11 37. Another team worked on rotomotion. This is similar to but different from character
 12 animation. The rotomotion team took a 3D rig capture of an actor's body and tried to match the
 13 motion of the actor's body as captured by the 3D rig with the motion of the actor in the plate
 14 performance. Other teams worked on rotoscoping and paint. The rotoscoping team outlined all the
 15 regions of any character that would overlap the Beast. For example, where Belle's hand passed
 16 over the Beast's face, we would have to cut out her hand with rotoscoping and superimpose it
 17 back on the renders of the Beast. The paint team was responsible for restoring whatever
 18 rotoscoping cut. Also, because the Beast had to be placed on top of plates that contained Mr.
 19 Stevens's image, we had to remove Mr. Stevens's on-set performance from the plate to ensure bits
 20 of him were not visible behind the Beast on screen. The paint team was responsible for repainting
 21 and projecting portions of the background or other content to remove the actor from the plate.
 22 Neither the rotomotion, rotoscoping, nor paint teams used Mova software. This work was
 23 performed by artists using their artistic talent, skill and judgment.

24 38. On each shot, the work of the various animation and effects teams occurred in
 25 parallel. During this process, a team working on one aspect of a shot would release a render of the
 26 shot so that other teams could build upon or account for that team's work. At various times the
 27 work of multiple teams would be integrated together. Once an artist from a team had approval to
 28 pass their work to the next team, they published their data for use by the next team. When some

1 teams (e.g. animation and CFX) published their work, a render was generated to check that all the
2 elements were intact for the next team. This is called a QC render. Mova software was not used by
3 the visual effects team to create QC renders.

4 39. At various times during the development of a shot, work from multiple teams was
5 assembled together by the compositing team. This team combined renders from the teams to create
6 a complete moving image. The compositing team did not use Mova software in this process. The
7 compositing work was performed by artists using their artistic talent, skill and judgment.

8 40. The steps described above in which Mova software was not used required hundreds
9 of person hours, sometimes more than a thousand, to complete for each shot. A frame from the
10 final composite of the same shot of the Beast referenced above is shown below. DD3 created 309
11 versions of this shot. Over 250 versions of the shot were created after Mova was ingested and
12 incorporated into the shot.



Figure 6

41. For shots that did not use Mova tracked mesh output data, DD3 followed the same
process as that described above, except DD3 did not use ingested Mova tracked mesh output data
in the process of developing a shot. If Mova tracked mesh output data was not ingested for use in
developing a shot, the animation team had no way of loading or referring to that tracked mesh

1 output data during the animation process.

2 42. For those shots in which Mova tracked mesh output data was used, the tracked
3 mesh output data had minimal effect on the Beast's appearance and performance in the final
4 version of the shot. This is so for at least three reasons.

5 43. First, the Beast generally had to match Mr. Stevens's plate performance. As noted
6 above, the plate performance is the footage taken of Mr. Stevens, sometimes with other actors, in
7 which he acted out a scene on a set, with scene appropriate lighting, etc. As also noted above, for
8 each shot DD3 creates a complete virtual environment with animated characters and content, much
9 like a real set would have characters and props. It is the plate performance that drives the overall
10 configuration of the shot, including how to animate the Beast to interact with the other actors and
11 characters, how to light the animated shot, and how to move and control the virtual camera in the
12 animated shot. The Mova camera rig was not used to capture footage for the plate performance
13 and Mova software was not used to process the footage of the plate performances. Because Mr.
14 Stevens's facial performance in the Mova rig rarely matched his plate performance, the Mova
15 tracked mesh output data often had to be adjusted, thereby reducing the impact of that tracked
16 mesh output data on the final version of the shot.

17 44. Second, the Beast's physical geometry is very different from that of Mr. Stevens.
18 By way of obvious example, the Beast is larger. Because of the differences in physical geometry,
19 the mapping of Mr. Stevens's performance onto the Beast's performance required extensive hand
20 animation, further diluting the impact of the Mova tracked mesh output data on the final version of
21 the shot.

22 45. Third, the Beast has fur, facial features, and costuming that Mr. Stevens does not.
23 All of these elements required their own extensive work to implement, animate, and integrate into
24 the facial motions and expressions of the character, and the impact of this work on the appearance
25 of the Beast and overall shot still further reduced the relative impact of the Mova tracked mesh
26 output data.

27 46. Thus, whether or not we ingested Mova tracked mesh output data for use in the
28 process of creating a particular shot, DD3 animators had to do substantial work to improve the

1 facial performance animation from the initial rough version of the animated face to the final
 2 version that appeared in the completed motion picture.

3 47. As noted, Mova is not the only technology used for facial motion performance
 4 capture. Other examples are Medusa and Di4D. Any facial motion performance capture tool can
 5 potentially be a useful time-savings tool. Because of the complexities of the Beast's appearance,
 6 however, the time-saving benefit from using Mova was minimal or non-existent. In hindsight, the
 7 amount of work needed to manually correct the animation post-ingestion of the Mova tracked
 8 mesh output data for the Beast was essentially the same, on average, as the effort that would have
 9 been needed to manually achieve the same or better results.

10 **Illustrative Examples – Background**

11 48. During my deposition I testified about a holding area where Mova output would be
 12 placed so as to be made available to the animation team. DD3 uses a proprietary tool called DMX
 13 to manage its shots. DMX is a custom render management and review system. Each time work is
 14 submitted, a render of the work is compiled into a small movie that can be reviewed. For each
 15 shot, DD3's DMX system contains (among other things) all of the stages of development of that
 16 shot, which the system tracks as "versions." Some shots for BATB have 300 or more versions,
 17 others have fewer than 50. Each version generally represents work done by an artist or engineer, or
 18 in the case of ingestion of Mova tracked mesh output data, the work done by Direct Drive.

19 49. Looking at the versions of a shot saved in DMX, I am able to determine whether or
 20 not Mova tracked mesh output data was delivered and available for the animation team to use in
 21 the process of developing the Beast's face for use in that shot. Any data sent by the Mova team for
 22 possible use in the process of developing a shot appeared in DMX. If Mova tracked mesh output
 23 data was used in the process of partially animating the Beast's face for any version of a shot, there
 24 would necessarily be a version of the shot in DMX that showed the mask-like rendering of the
 25 tracked mesh output data and a version that showed Dan Stevens's head side-by-side with the
 26 facial rig of the Beast. As a matter of practice there would be a version with a comment indicating
 27 that it reflected the ingestion of Mova tracked mesh output data. If these three versions do not exist
 28 in DMX for a shot, then Mova tracked mesh output data was never ingested into that shot.

1 50. As an example, Exhibit 1 is a spreadsheet for shot MSM0250 generated from
 2 DMX. Each line of the spreadsheet reflects a different version of the shot. The information in
 3 Exhibit 1 was generated automatically from DMX. A Mova ingestion will generally be labeled
 4 with the shot name “_anim_mova_qc_v001” or similar. For example, line 85 of the spreadsheet
 5 reflects that Mova was ingested into shot MSM0250 after version 5.

6 51. DMX maintains videos of each version of a shot, along with thumbnails of each of
 7 those videos. I can identify if Mova was ingested for use in a particular shot by looking at the
 8 thumbnails of images in DMX to see if they show the mask-like rendering of the tracked mesh
 9 output data and images of Dan Stevens’s face side-by-side with a hairless Beast face.

10 52. Exhibit 2 reflects the thumbnails of the videos maintained in DMX for the different
 11 versions of shot MSM0250. Version 5 (labeled “MSM0250_v005; MSM0250_anim-
 12 mova_qc_v005”) shows the mask-like rendering of the tracked mesh output data, and Version 6
 13 (labeled “MSM0250_v006; MSM0250_rigblast_v001”) shows the side-by-side images of Mr.
 14 Stevens and the hairless Beast face.

15 53. Reviewing the information in DMX, I was able to determine that Mova was
 16 ingested for 227 of the 411 Beast shots that DD3 animated. For the shots on which Mova was not
 17 ingested, Mova tracked mesh output data was not used in the process of developing that shot.
 18 When Mova tracked mesh output data was ingested, it was sometimes a dead-end in that the
 19 results of ingestion were not used as the basis for further work. But even when Mova tracked mesh
 20 output data was ingested and not abandoned, substantial additional work was done by the visual
 21 effect team, including the animation team, as explained above and illustrated below.

22 **MSM0250: Lingering Beast Shot**

23 54. Shot MSM0250 is about six seconds long. I selected it as an example because in
 24 the shot, the face of the Beast is prominent. Shot MSM0250 took 73 versions to complete.

25 55. Exhibit 2 is a screenshot from DMX. It shows thumbnail representations of all the
 26 content in DMX for that shot: reference material and shot versions.

27 56. As discussed above, Exhibit 1 is a spreadsheet I created using DMX. The
 28 spreadsheet lists all of the content in DMX for this shot. The spreadsheets discussed below, in the

1 context of other example shots, similarly list all of the content in DMX for those shots. For each
 2 version and for most of the reference material each spreadsheet includes, *inter alia*: the person
 3 who checked in that content, the time and date of the check-in, and a contemporaneous description
 4 of the content. The time between versions is only suggestive of the effort involved in each version.
 5 Because animators work on multiple shots and because other tasks may arise, it is not possible to
 6 exactly pinpoint the amount of time spent working on a particular version. Nevertheless, the
 7 amount of time elapsed between two versions produced by a team does provide a rough estimate
 8 of the amount of time devoted to the more recent version.

9 57. Exhibits 3 through 18 are videos. Each is a true and correct copy of a video stored
 10 in DMX and associated with shot MSM0250. I included a video for each of the entries that I
 11 discuss below.

12 58. I have not included all of the videos in DMX for MSM0250 or the other shots
 13 discussed below. Instead, the examples highlighted below are intended to illustrate some of the
 14 many steps involved the creation and evolution of a shot. By viewing the videos included as
 15 exhibits and reviewing the spreadsheet and thumbnails exported from DMX, one gets a general
 16 understanding of the evolution of the shot and the work involved in creating the shot. Mova
 17 software was used only in the process of capturing the facial performance for this shot and
 18 processing output data. All of the other work described below, and reflected in the 73 versions of
 19 this shot, involved the work of artists using their artistic talent, skill, and judgment, implemented
 20 using software and processes other than Mova (such as Direct Drive and other software I
 21 mentioned above).

22 59. Exhibit 3 is reference material for MSM0250 sent to us from editorial. My
 23 understanding of how such clips were generated is as follows. First, editorial selected the plate
 24 performance they like best for the shot. This became the master performance we were generally
 25 trying to match in the animation. Then, the Mova team sent editorial reference footage from the
 26 Mova facial capture session for the shot. This footage was delivered as a single video (in the
 27 QuickTime format mentioned above) that showed, side-by-side, the output of three of the cameras
 28 that filmed Mr. Stevens during the Mova capture session. I am informed and believe that editorial

1 would then line up their selected plate performance with the takes of Mr. Stevens's facial motion
2 capture session that editorial thought looked closest to his plate performance. Editorial would then
3 generate a "picture-in-picture" video, which was a composite of the selected Mova take
4 synchronized with the plate performance to which it corresponded. Editorial would send the
5 picture-in-picture to DD3 as a Quick Time file, along with a modified version of the original video
6 received from DD3's Mova team. Exhibit 3 is the picture-in-picture video received from editorial
7 for MSM0250. In Exhibit 3, Mr. Stevens's facial motion capture performance is shown in the
8 three-part image at the bottom left hand side of the screen, and his plate performance is shown in
9 the background. When DD3 received this video from editorial, we used the timecodes on the facial
10 motion capture performance included in the composite video to determine which frames from the
11 facial motion capture session, if any, that the Mova team should provide the VFX team for
12 possible ingestion.

13 60. Exhibit 4 is the result of "previsualization," in which low resolution versions of the
14 characters and sets are made to test out how to best shoot the various shots. This provides a guide
15 for shooting and for VFX. It does not involve any Mova software or any Mova output data. I have
16 included this video to illustrate some of the work that goes into preparing for a shot, unrelated to
17 Mova.

18 61. Exhibit 5 is a video of version 2 of the shot. Version 2 is an attempt to track the
19 virtual camera in relation to the contours of the environment and the characters. The wireframe
20 seen here is not Mova output data and not from a facial motion capture session. The wire view
21 represents the simulated version of Mr. Stevens. The fact that it largely overlaps with the plate
22 image of Mr. Stevens demonstrates that the virtual camera is correctly positioned.

23 62. Exhibit 6 is reference footage of the actor's facial performance in the Mova rig.
24 The VFX team would receive these images when we received the Mova tracked mesh output data
25 from the Mova group at DD3. We would primarily use this footage to quality control any Mova
26 tracked mesh output data, as described above. Exhibit 7 is similar to Exhibit 6, but it is not head-
27 stabilized. The head-stabilized version is an attempt to isolate the facial movement, as
28 distinguished from the motion of the head. The Beast's head motion was always animated to

1 match the live action plate performance, not the Mova performance.

2 63. Version 4 of the shot (Exhibit 8) is the last version before ingestion of Mova
3 tracked mesh output data. We refer to this relatively blocky animation as a “playblast.” The
4 playblast is a quick render that allows us to see the basic performance of the Beast. The body of
5 the Beast is already partially animated, based off of Mr. Stevens’s plate performance, not his facial
6 motion capture session. The eyes and eye region are also animated, again based on the plate
7 performance, not the facial motion capture session. Mova software is not used to create the
8 playblast.

9 64. Version 5 of the shot (Exhibit 9) is a render of the Mova tracked mesh output data.

10 65. Version 6 of the shot (Exhibit 10) is the result of Direct Drive mapping the tracked
11 mesh output data to the animation team’s existing Beast model.

12 66. Version 7 of the shot (Exhibit 11) is the version of the entire shot that has utilized
13 the Mova tracked mesh output data. No other animation has been done since Version 4. When
14 comparing version 4 and version 7, notice, e.g., that the eye performance is unchanged from the
15 prior animation.

16 67. Version 8 of the shot (Exhibit 12) contains hand animation tweaking and improving
17 the shot since the ingestion of the Mova output data.

18 68. Versions 9 through 24, as described in Exhibit 1, reflect the work of the animation
19 team as well as other VFX teams.

20 69. The video of version 25 of the shot (Exhibit 13) is included as an example of the
21 cumulative effect of this additional non-Mova related work on the facial performance of the Beast.
22 Comparing this version to version 7, which is the version that utilizes the tracked mesh output
23 data, I observe that no part of the Beast’s face is unmodified, from the expressions to the timing of
24 the performance. In the lower right hand corner of the video of version 25 in Exhibit 13, there is a
25 frame counter. Around frame 1110, I can see on version 25 that the inner brows and eyes have
26 been changed to give a much more shocked and sad expression and the mouth has been opened
27 wider and dropped down. Figure 7 is a screenshot of frame 1111 in version 7. Figure 8 is a
28

1 screenshot of frame 1110 in version 25.



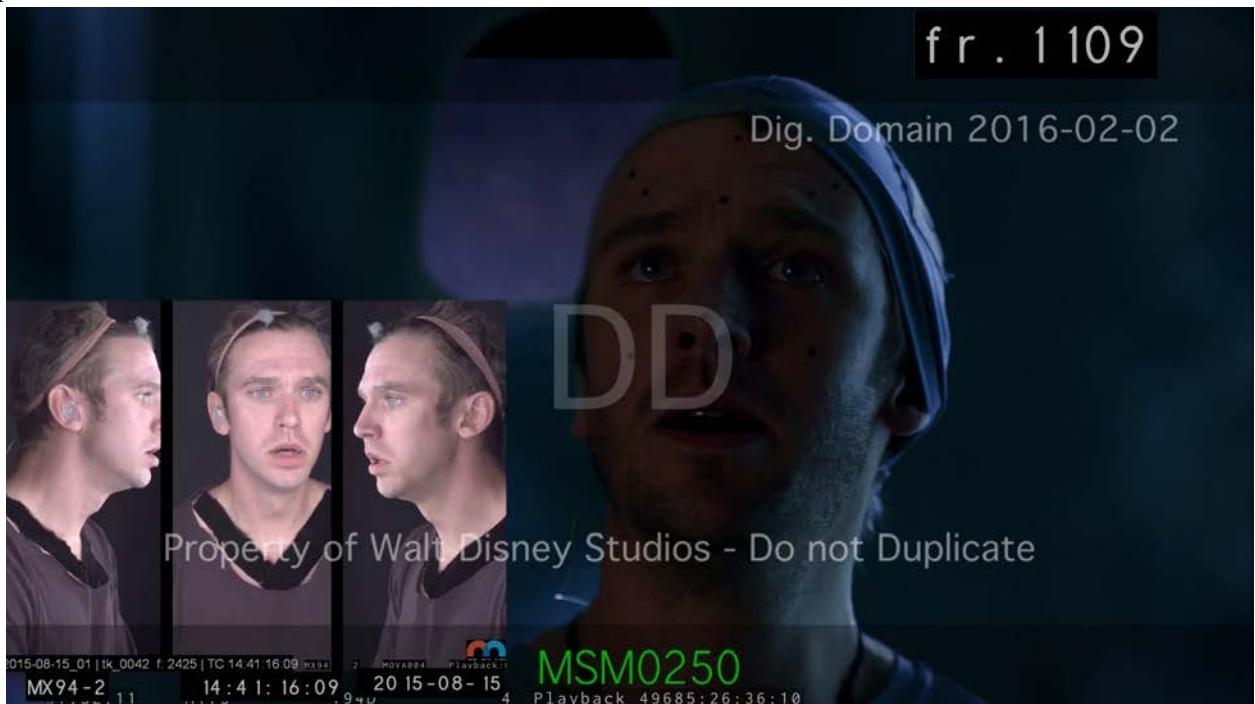
13 **Figure 7**



25 **Figure 8**

26 70. Comparing version 25 to the reference footage of Mr. Stevens's facial performance
27 in the Mova rig, I can also see that the version does not track the Mova performance. Version 25 is
28

1 the opposite of what Mr. Stevens was doing in the Mova rig: in the Mova facial motion capture at
 2 frames 1109-1111 Mr. Stevens starts to look down, lower his brows and raise his jaw. But Version
 3 25 tracks more closely to the plate performance. I can observe these differences in Figure 9, which
 4 is a screenshot of frame 1109 from the picture-in-picture for this shot (Exhibit 3) showing both the
 5 facial performance in the Mova rig (in the three-part image at the bottom) and the plate
 6 performance.



18 **Figure 9**

19
 20 71. Exhibit 14 is a “QC” render. At several stages in the process the various VFX
 21 teams (e.g.: animation, rotomotion, CFX (character effects: e.g., clothing and hair), shot model,
 22 lighting, rotoscoping, paint, rigging, environments, effects, integration) will publish their latest
 23 work to be used by other teams. At various point in time, a quality control (“QC”) render is
 24 produced to ensure the process of wrapping up all the data for use by other teams was successful.
 25 Mova software was not used to generate this QC render.

26 72. In version 38 of the shot (Exhibit 15), the lighting team has taken the animated
 27 character, now with fur and clothing, and placed lights in 3D space to simulate the lighting of the
 28 scene as shot in the plate performance. Mova software was not used in any of this work.

1 Overlayed on the shot is a plate performance so that the animators can account for the lighting
 2 used in that performance. In this version the plate performance appears in the upper right hand
 3 corner. In this version, one can also see that the Beast's eye and eyebrow animation, completely
 4 absent from version 7, have undergone extensive work. Comparing the plate performance with the
 5 Beast's face, I see that the animation changes made in version 25 modified the expressions and
 6 timing to better match Mr. Stevens's plate performance (upper left), not his facial capture
 7 performance.

8 73. Version 48 of the shot (Exhibit 16) reflects work by the CFX team. The artists are
 9 simulating, for example, the clothing moving and fitting against the Beast's body. Version 49 of
 10 the shot (Exhibit 17) reflects work by the CFX team on hair effects, including trying to get the
 11 motion of the hair (and clothing) correct. Mova software was not used in the CFX team's work

12 74. After another 20+ versions, version 73 of the shot (Exhibit 18) is a final shot. It is
 13 the composite of all the most recent work by the various teams mentioned above.

14 **WAL0550: Waltz Shot**

15 75. Shot Wal0050 is one of 35 shots that DD3 worked on from a scene of the Beast and
 16 Belle dancing a waltz. The frames depicted in Figures 1 through 6 above come from this shot.

17 76. Shot WAL0550 is an example of a shot in which Mova tracked mesh output data
 18 was ingested but for which it had particularly little impact, both because the focus is rarely on the
 19 Beast's face and because there are so many other elements in the shot.

20 77. Exhibit 19 is a screenshot from DMX, similar to that included for the previous shot.
 21 It shows thumbnail representations of all the content in DMX for WAL0550.

22 78. Exhibit 20 was exported from DMX. This spreadsheet lists all of the content in
 23 DMX for this shot.

24 79. Exhibits 21 through 35 are videos that illustrate some of the many steps in the
 25 development of this shot, which took more than 300 versions to complete. Each of these video
 26 exhibits is a true and correct copy of a video associated with shot WAL0550 in DMX. Mova
 27 software was used only in the process of capturing the facial performance for this shot and
 28 processing output data. All of the other work described below, and reflected in the more than 300

1 versions of this shot, involved the work of artists using their artistic talent, skill and judgment, and
2 software and processes other than Mova such as Direct Drive.

3 80. Exhibit 21 is a reference sent to us from editorial. As with the comparable exhibit
4 from shot MSM0250, Exhibit 21 contains video of a plate performance lined up with video of a
5 facial motion capture performance. At DD3, we looked at the timecodes on the facial motion
6 capture included in the reference video to determine which frames of the Mova tracked mesh
7 output data to ingest for use in developing the shot.

8 81. Exhibit 22 is version 3 of the shot. This shows some of the work of DD3's
9 rotoscoping department. Here, that team has outlined the regions of Belle that the Beast has to go
10 underneath or behind. For example, if her hand goes over the Beast's face then we will eventually
11 have to cut out her arm with rotoscoping and superimpose it back onto the renders of the Beast.
12 Mova software was not used for rotoscoping work.

13 82. Exhibit 23 is a render of the tracked mesh output data, which appears as a moving
14 mask of Mr. Stevens's facial motion capture session for this shot. The reference footage of Mr.
15 Stevens performing in the rig appears next to the render of the tracked mesh output data.

16 83. Exhibit 24 is version 18 of the shot. The video shows the result of using Direct
17 Drive to map the tracked mesh output data to the animation team's existing Beast model.

18 84. Version 49 (Exhibit 25) is the last version from the animation team before the
19 application of the tracked mesh output data. This is the playblast that I described above. It was
20 created without using Mova software.

21 85. Version 56 of the shot (Exhibit 26) is the version of the entire shot that incorporates
22 the Mova tracked mesh output data. No additional hand animation was done on the shot between
23 Version 49 and version 56. I can see that the difference in the Beast's facial performance between
24 the two versions is imperceptible. The tracked mesh output data has had almost no effect on the
25 performance in this shot.

26 86. Animation is previewed in two forms: a very simple render and a more complete
27 render with better lighting. Version 71 (Exhibit 27) is a simpler playblast, version 72 (Exhibit 28)
28 is the more complete "comp" or composite render.

1 87. Exhibit 29 is another QC render. As I stated above, at several stages in the process
 2 the work of the various VFX teams (e.g., animation, CFX, shot model, lighting, rigging, etc.) is
 3 QC'd for use by other teams.

4 88. Version 81 (Exhibit 30) shows paint work, as described above. Mova software was
 5 not used in paint work.

6 89. Version 134 (Exhibit 31) is from the shot model team. Often the face and the body
 7 of the Beast don't look anatomically correct, and this team goes frame by frame and hand sculpts
 8 the correct muscles and motion to ensure the final forms look physically correct. The shot model
 9 team did not use Mova software for shot modeling.

10 90. Version 214 of the shot (Exhibit 32) reflects work on the clothing effects. In
 11 particular, the CFX artists are simulating the clothing moving and fitting against the Beast's body.
 12 This is a low quality render to preview the motion.

13 91. Exhibit 33 is a cloth and hair effects render. The cloth and hair teams simulate the
 14 clothing against the Beast's moving body to create a physically correct clothing and hair motion.
 15 This is a higher quality render in order to better preview the motion,

16 92. Version 306 (Exhibit 34) is a CFX render, in which the team has simulated the
 17 computer generated Belle dress against Belle's computer generated body and the Beast's body and
 18 clothing. This is used to check the motion is correct. The CFX team did not use Mova software for
 19 CFX work.

20 93. Version 309 (Exhibit 35) is the final version of the shot, the "composite." A
 21 compositor assembles all the individual renders from all the different team and created a complete
 22 shot with lensing effects to look "real." The compositor does not use Mova software for
 23 compositing work.

24 **WFA0605: Wolf Fight – Mova Tracked Mesh Data Ingested but Not Used**

25 94. Shot WFA0605 is less than two seconds in duration and went through 146 versions.
 26 It is part of a scene that in which the Beast is fighting with wolves. As with the other shots
 27 described herein, Mova software was used only in the process of capturing the facial performance
 28 for this shot and processing output data. All of the other work described below and reflected in the

1 146 versions of this shot involved the work of artists using their artistic talent, skill, and judgment,
2 and applying software and processes other than Mova, such as Direct Drive and the software I
3 mentioned above.

4 95. Exhibit 36 is a screenshot from DMX, similar to that included for the previous
5 shots. It shows thumbnail representations of all the content in DMX for WFA0605.

6 96. Exhibit 37 was exported from DMX. This spreadsheet lists all of the content in
7 DMX for this shot.

8 97. Exhibits 38 through 52 are videos that illustrate some of the many steps in the
9 development of this shot. Each is a true and correct copy of video content associated with shot
10 WFA0605 in DMX.

11 98. Exhibit 38 is a reference sent to us from editorial. As with the comparable exhibits
12 from the shots discussed above, it contains a plate performance lined up with a Mova
13 performance. The plate performance drives the shot and is captured without the use of Mova
14 software.

15 99. Exhibit 39 is a render of the tracked mesh output data; a moving mask of Dan
16 Stevens's performance during his Mova capture session for this shot.

17 100. Exhibit 40 is version 6 of the shot. This is a QC render of the Mova tracked mesh
18 output data transferred onto our Beast face through the Direct Drive process.

19 101. Exhibit 41 is version 9 of the shot. It is a quick animation render of the Beast and
20 wolf. It may include the results of using Direct Drive to ingest the Mova tracked mesh output data.
21 The quality of the render makes that difficult to determine.

22 102. Exhibit 42 is a QC render that integrates the work of various teams, including the
23 animation team, CFX team, and shot model team. As discussed above, those teams did not use
24 Mova software in their work.

25 103. Exhibit 43 is version 50 of the shot. It is a reference plate of a variety of different
26 growl expressions that animators can refer to when making later modifications to the animation of
27 the face. The reference material in this version includes the facial expression of both Mr. Stevens
28 and a second actor.

1 104. Exhibit 44 is version 57 of the shot. This is an animation comp, a higher quality
2 animation render used to check the animation in the scene. Mova software was not used to create
3 the animation comp.

4 105. Exhibit 45 is version 76 of the shot. It is a CFX render, similar to others I mention
5 above. The team simulates the strands of the Beast's hair against the Beast's moving body and
6 clothing to create a physically correct hair motion. This is a very low quality render to preview the
7 motion. The CFX team did not use Mova software in their work.

8 106. Exhibit 46 is version 83 of the shot. It is a comp from the effects team, rendering
9 bits of saliva from the wolf and the Beast's mouths. Mova software was not used to add these
10 effects.

11 107. Exhibit 47 is version 102, which is a close to final version of the animation. I have
12 lined up the animation of the Beast's face to the images from the facial performance capture
13 session and the rendering of the Mova tracked mesh output data and I can see that the timing of
14 movements on, and the performance of, the Beast's face have been completely redone and are not
15 based on the facial performance capture session or the Mova tracked mesh output data.

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1 108. For example, as illustrated in the frame screenshots I compiled in Figure 10 below,
2 when I look at frame 1043 I can see in the Mova facial capture footage (in the upper left corner of
3 Figure 10) that Mr. Stevens's teeth are clenched, his nose is wrinkled, and his eyes are open. In the
4 animation render at frame 1043 (version 102, shown at the bottom of Figure 10) and the lighting
5 render at frame 1043 (version 144, shown at the upper right of Figure 10), the Beast's mouth is
6 wide open, his fangs are bared, and his eyes are shut tight.

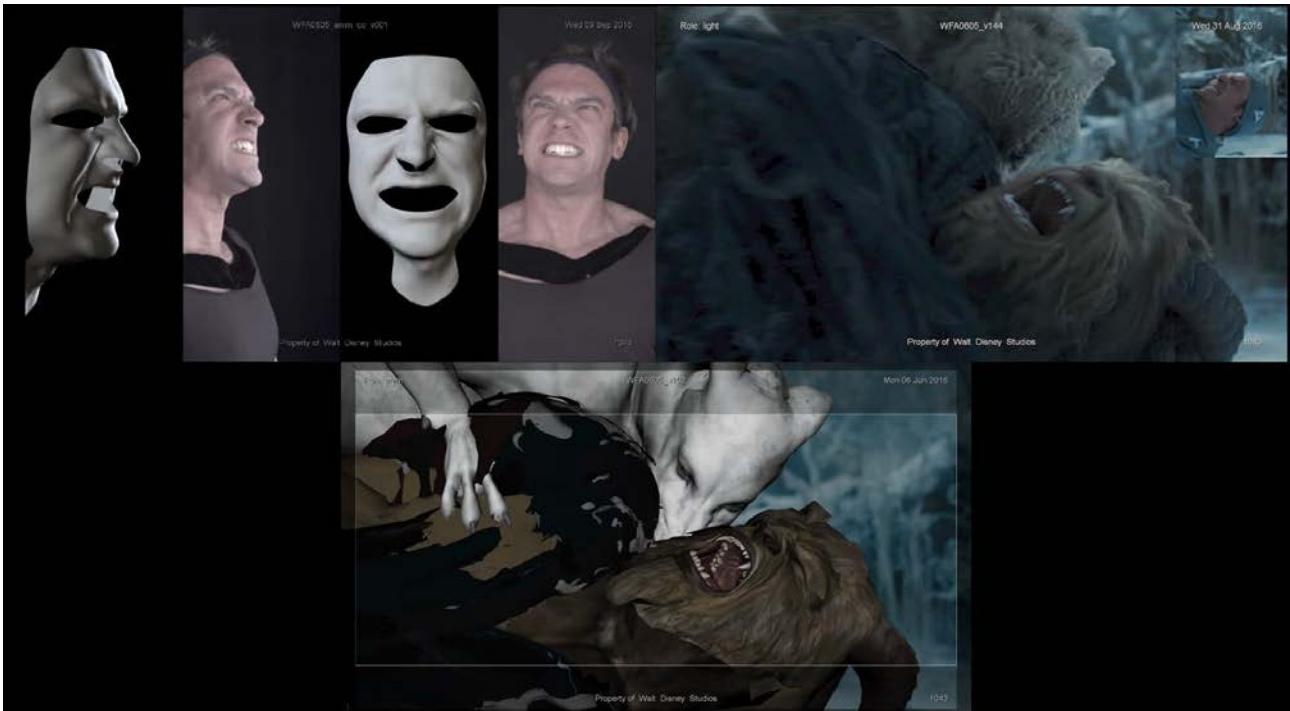


Figure 10

1 109. Figure 11 similarly shows that the final version of the Beast in this shot does not
2 track the Mova facial capture performance. Figure 11 shows screenshots I compiled of frame 1055
3 of the shot. In frame 1055, in the facial capture (depicted at the upper left of Figure 11), Mr.
4 Stevens's mouth is wide open and he is looking up and to the right, while in the animation render
5 (at the bottom of the figure) and the lighting render (at the upper right of the figure) the Beast's
6 mouth is only half open and his eyes are shut.

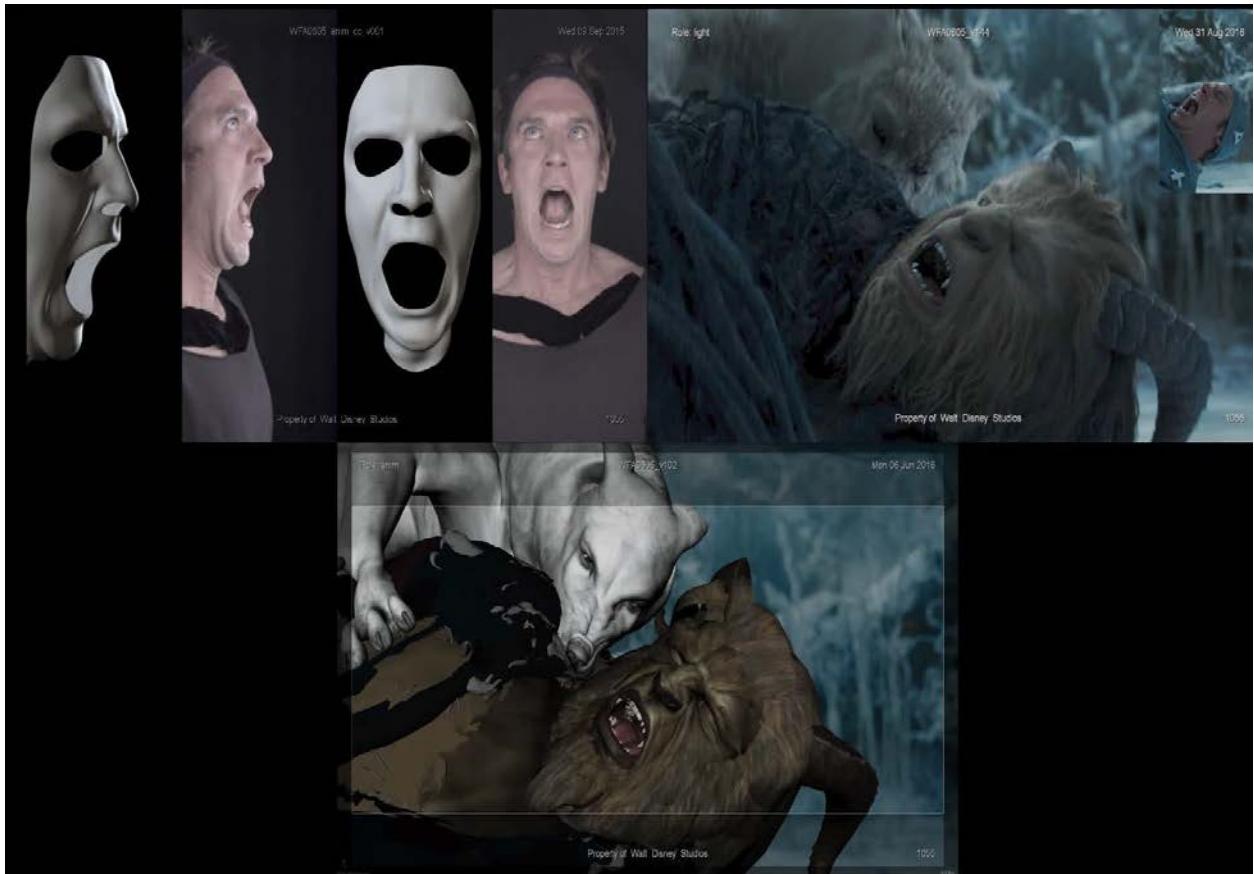


Figure 11

110. Exhibit 48 is version 130, from the shot model team. Often the face and the body of the Beast don't look anatomically correct, so this team goes frame by frame and hand sculpts the correct muscles and motion to ensure the final forms look physically correct. Mova software is not used in this shot modeling.

111. Exhibit 49 is another CFX render, focusing on clothing and hair effects, as described above. This render is a higher quality render in order to better preview the motion.

1 112. Exhibit 50 is version 137. This is a lower quality CFX render, intended to preview
2 the motion. Again, the CFX team did not use Mova software in this work.

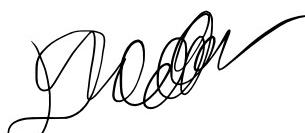
3 113. Exhibit 51 is version 144. The lighting team took the latest published version from
4 the CFX and animation team and placed digital/virtual lights around the 3D scene to match the
5 lighting from the plate. The team is trying to create a render of the Beast in which he looks like he
6 was in the set with the correct lighting. This is done without using Mova software. Generally on
7 these shots Mr. Stevens's performance from the plate (not Mova) is overlayed so we can see that
8 the lighting matches and that the performance works. In this case, when I check the Beast's face
9 against the Mova capture and the live action plate, I can see this animation more closely resembles
10 the live action plate (but has been heavily modified).

11 114. Exhibit 52 is version 146 of this shot. A compositor has assembled all the
12 individual renders from all the different teams and integrated the layers together, complete with
13 lensing effects, to create a final shot that looks real. Again, Mova software is not used for
14 compositing work.

15
16 I declare under penalty of perjury under the laws of the United States of America that the
17 foregoing statements are true and correct.

18 Executed on October 13, 2020, at Los Angeles, California.

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DARREN HENDLER